

Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum

EAA: A Valuable Enterprise Framework
PLM Market & Industry Forum
A CIMdata PLM Leadership Event
6 April 2022

Peter Bilello, President & CEO
Email: p.bilello@CIMdata.com
Tel: +1.734.668.9922

CIMdata[®]

Global Leaders in PLM Consulting
www.CIMdata.com

#plm4um

Copyright © 2022 by CIMdata, Inc.

Our Mission...

Strategic management consulting for competitive advantage in global markets

CIMdata is the leading independent global strategic management consulting and research authority focused exclusively on PLM and the digital transformation it enables.

We are dedicated to maximizing our clients' ability to design, deliver, and support innovative products and services through the application of PLM.

CIMdata[®]

Copyright © 2022 by CIMdata, Inc.

2

Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum

Key Takeaways

EAA: A Valuable Enterprise Framework—2022 CIMdata PLM Market & Industry Forum

- PLM isn't implemented as a single IT system, but rather a set of solutions that enable a wide range of capabilities that must work together
 - As well as with a host of related enterprise applications
- Getting an enterprise application architecture wrong not only costs money but potentially suboptimizes PLM's impact, as well as other applications
 - Companies must guard against this—failure is costly & not an option for most
- It is for these reasons CIMdata created and rolled out its Enterprise Application Architecture™ framework
 - Such a framework can be used to help assess current application environments, define or implementation roadmaps, as well as guide implementations
- Such frameworks must be open, scalable, and neutral—change happens

CIMdata®

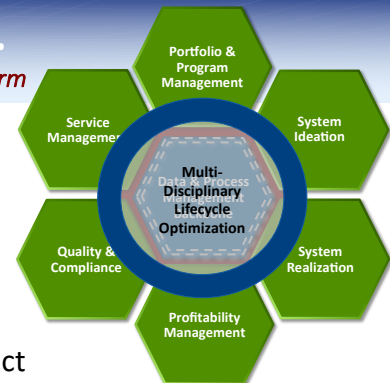
Copyright © 2022 by CIMdata, Inc.

3

So, What is Product Lifecycle Mgmt.

Digital transformation of the lifecycle—enabled by a product innovation platform

- Strategic business approach
 - **NOT** just technologies
 - Consistent set of business solutions
- Collaborative creation, use, management & dissemination of product related *intellectual assets*
 - All product/plant definition information – the virtual product
 - AEC, MCAD, EDA, ALM, SE, requirements, simulations, analytics, portfolio, formulas...
 - All product/plant process definitions – the virtual processes
 - Processes that plan, design, produce, operate, support, decommission, recycle...
- An innovation platform that supports the extended enterprise
- Spans the full lifecycle, from idea/concept through life



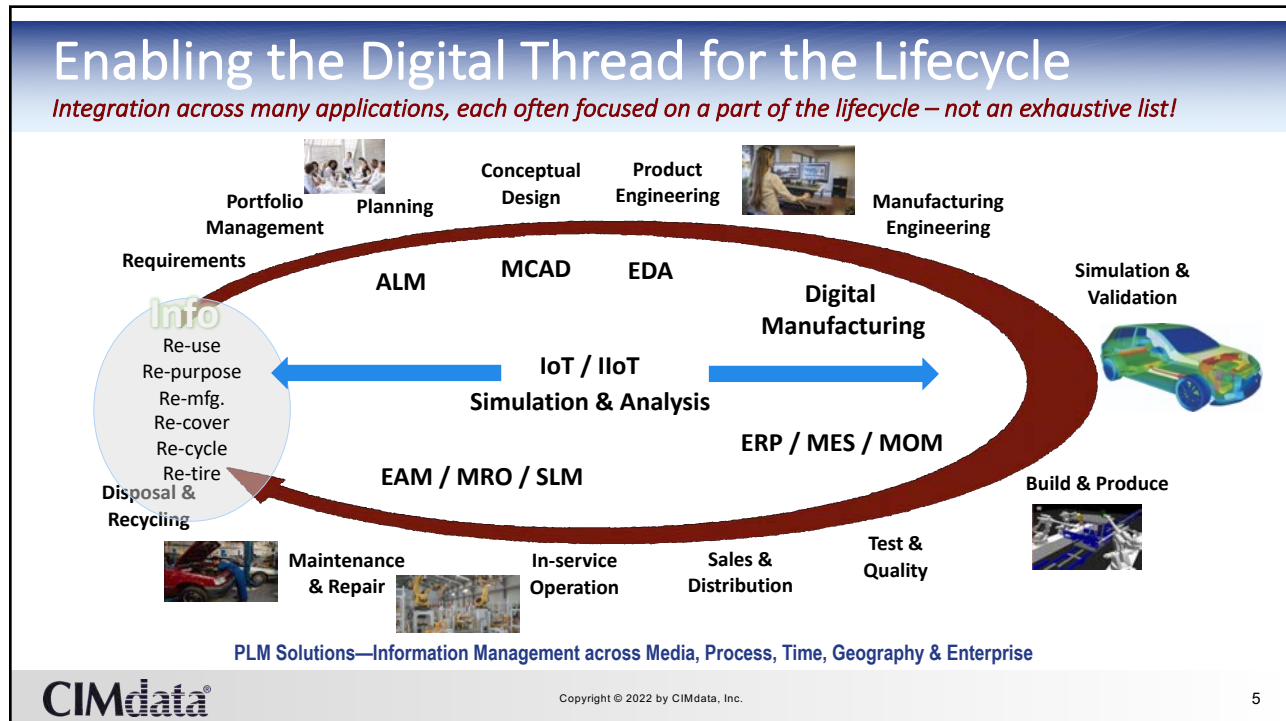
CIMdata®

Copyright © 2022 by CIMdata, Inc.

4

Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum



ET, IT & OT Technology Convergence is Required

Closing the multiple systems of systems loops that exist throughout an enterprise

- The integration of ET & IT systems used for data-centric creation & computing with OT systems used to monitor events, processes and devices, and adjust enterprise and industrial operations
 - ET includes those systems and tools that support the development and evaluation of product and process definitions (i.e., an organization's product-related IP)
 - IT includes any use of computers, storage, networking devices and other physical devices, infrastructure and processes to create, process, store, secure, and exchange all forms of electronic data
 - OT, traditionally associated with manufacturing and industrial environments, includes industrial control systems (ICS) such as supervisory control & data acquisition (SCADA)
- Convergence enables more direct control & more complete monitoring, with easier analysis of data from these complex systems

<https://searchitoperations.techtarget.com/definition/IT-OT-convergence>

CIMdata Copyright © 2022 by CIMdata, Inc. 6

Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum

Agenda

Enterprise Application Architecture: A Valuable Enterprise Framework

- Why Use an EAA Framework
- CIMdata's EAA Framework
- Sample Use of an EAA Framework
- Concluding Remarks



Copyright © 2022 by CIMdata, Inc.

7

Perhaps the Vision is Enabling a Higher MBE Level

Seven levels of MBE as defined by the Next-Generation Model-Based Enterprise Maturity Index

Drawing-Centric	Model-Centric	Validated Model-Centric	Formalized Model-Based Definition	Trusted Model-Based Definition	Integrated Model-Based Enterprise	Extended Model-Based Enterprise
Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
<ul style="list-style-type: none"> • 2D Static Drawings Only • Models ad-hoc • Models not managed • Disconnected manufacturing / disconnect enterprise 	<ul style="list-style-type: none"> • 3D models create 2D drawings • STEP AP203 derivative • CAX STEP & 2D drawings • Models may be managed 	<ul style="list-style-type: none"> • 3D models create drawings & derivatives • Model checked and derivative compared & managed • Certificate of Model quality • CAX derivatives w/2D drawings • Model images <p>Current State</p>	<ul style="list-style-type: none"> • Model-based definition (3D PMI, metadata) • 3d interactive viewable • 3D technical data packages • Lightweight viewing • MB animation • MBD, derivative & CAX managed 	<ul style="list-style-type: none"> • Model-based definition • Digital manufacturing certificate • LOTAR • 3DIV, 3D TDP, TDP deployed from PLM • TDPs used • Integrated mfg. 	<ul style="list-style-type: none"> • Model-based Enterprise • Model-based definition w/product characteristics • Auto MBD/TDP internal operation • LOTAR+ • Integrated mfg. <p>Future State</p>	<ul style="list-style-type: none"> • Model-based Enterprise • Model-based definition w/product requirements • Authenticated digital exchange • Auto MBD/TDP deployment to external operation • Integrated mfg.
File-Sharing	Doc-Centric PDM	Doc-Centric PDM	Part-Centric PLM	Part-Centric PLM	Digitally "1" PLM	Extended PLM
2D Drawings Authorized	2D Drawings Authorized	2D Drawings Authorized	2D Drawings Authorized	3D Model Authorized	3D Model Authorized	3D Model Authorized
Design Activities		Product Data Management Activities		Manufacturing Activities		Quality Activities
Enterprise Enabling Activities						

From the Proceedings of the 11th Model-Based Enterprise Summit (MBE 2020); April 2020.

Copyright © 2022 by CIMdata, Inc.

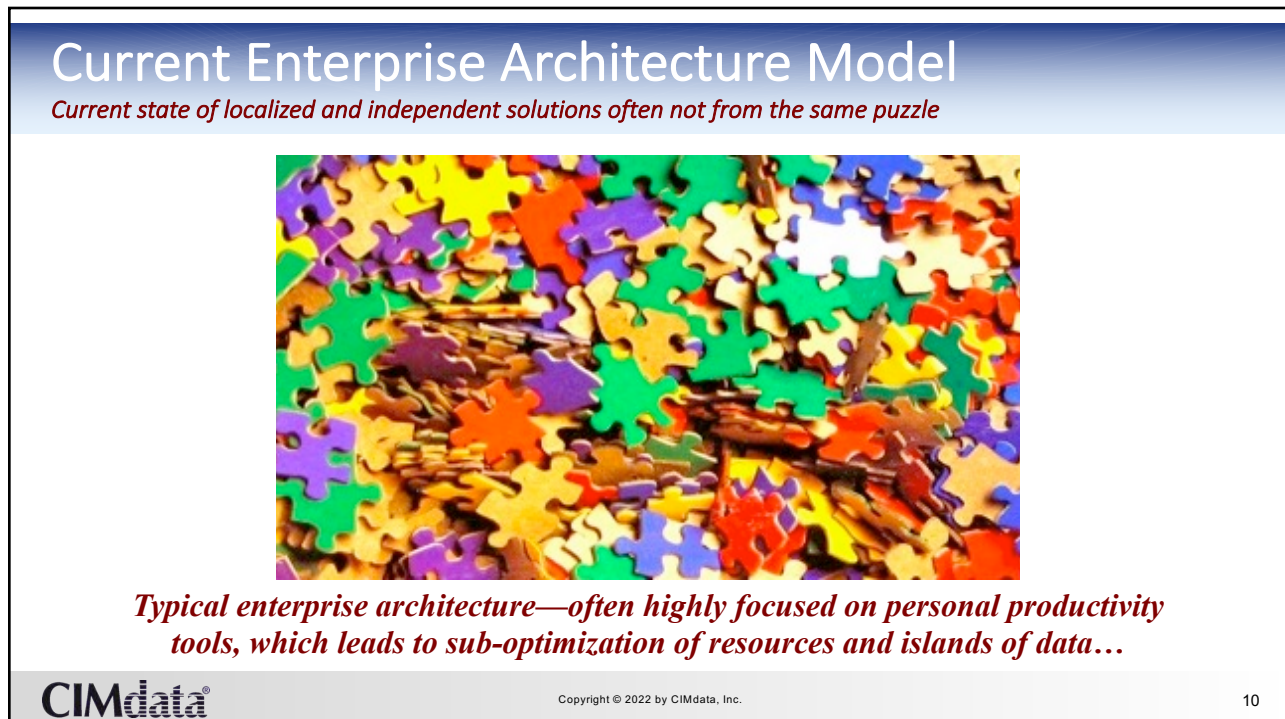
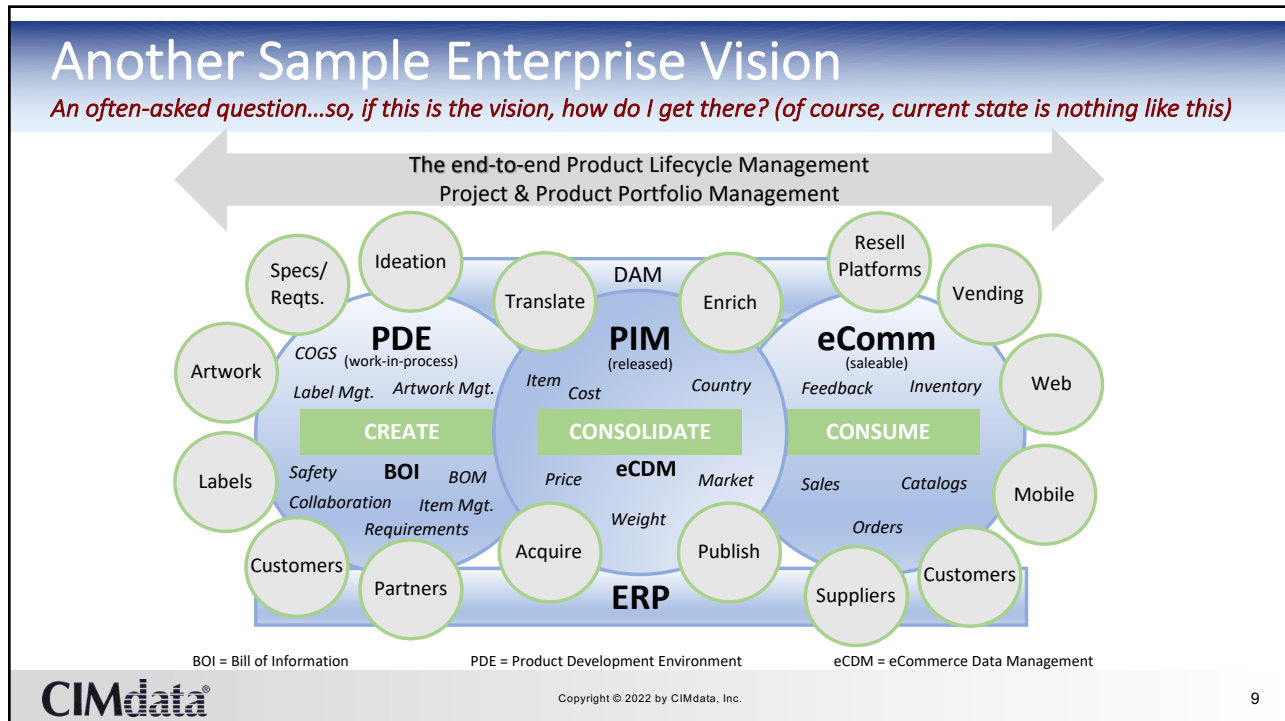
8



This presentation is copyright © 2022 by CIMdata, Inc. Clip art may be copyrighted. No use, reproduction or modification is permitted without prior written permission.
 CIMdata® is a registered trademark of CIMdata, Inc.

Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum



Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum

Proposed Enterprise Architectural Framework

Targeted future state of right-sized data solutions and business process enablement



We get here though an Enterprise Application Architecture framework

CIMdata®

Copyright © 2022 by CIMdata, Inc.

11

Agenda

Enterprise Application Architecture: A Valuable Enterprise Framework

- Why Use an EAA Framework
- CIMdata's EAA Framework
- Sample Use of an EAA Framework
- Concluding Remarks

CIMdata®

Copyright © 2022 by CIMdata, Inc.

12

Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum

CIMdata's Enterprise Application Architecture™

Enterprise Application Architecture begins with an Information Capabilities Model

- CIMdata's Enterprise Application Architecture (EAA) describes a comprehensive Enterprise Application Architecture framework
- It has been defined in terms of information capabilities that are defined and directed by the organization's Business & Technology Platform
- The information capabilities are processes and technologies (i.e., functional capabilities) that are used to perform a business function
- In general, input into the enterprise application architecture or framework is from an organization's suppliers and the output is to its customers
- The model was initially developed because of the significant disconnect we have seen in organizations' architecture, as well as the incomplete and/or the lack of understanding concerning the role PLM plays in an ent. arch.

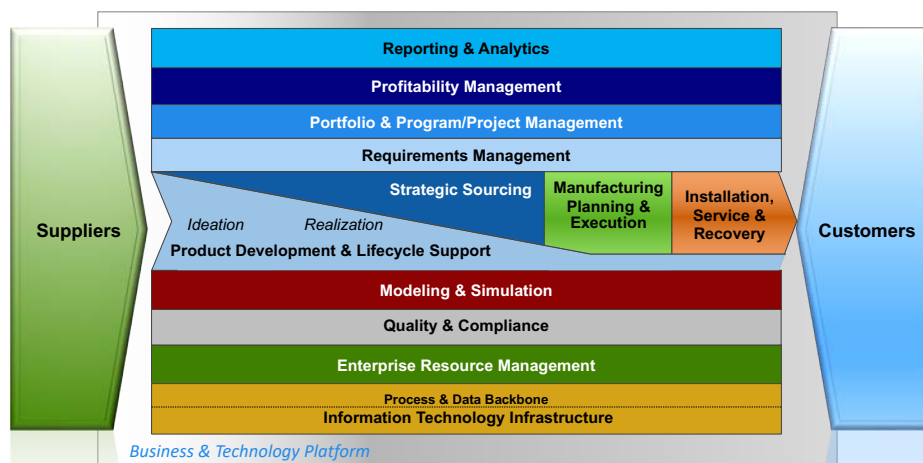


Copyright © 2022 by CIMdata, Inc.

13

Enterprise Application Architecture Framework

CIMdata's Enterprise Application Architecture™



Copyright © 2022 by CIMdata, Inc.

14

Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum

Enterprise Application Architecture™

Enterprise Application Architecture Capabilities Framework

The diagram illustrates the Enterprise Application Architecture Capabilities Framework. It is structured as follows:

- Reporting & Analytics**
- Profitability Management**
- Application Area** (encompassing the above)
- Portfolio & Program/Project Management**
- Requirements Management**
 - Ideation
 - Idea Management
 - Portfolio Profitability Management
 - Product Portfolio Planning
 - Brand Experience Management
- Suppliers** (left side)
- Customers** (right side)
- Capabilities** (central focus)
 - Customer Experience Architecture
 - Product Marketing Architecture
 - Sales & Market Configuration
 - IP Management
 - Transition Management
- Program Management**
 - Tracking & Control
 - Profitability Forecasting
 - Resource Management
 - Risk Management
 - Program Value Management
 - Schedule Management
- Focus Areas**
 - Project Management
 - Time Management
 - Scope Management
 - Integration Project Management
 - Quality Management
 - Risk Management
 - Requirements Management
 - Project Workspace
 - Issue Management
- Business & Technology** (bottom layer)

Each Application Area is composed of one or more Focus Areas, each of which in turn is composed of a set of related information capabilities.

CIMdata Copyright © 2022 by CIMdata, Inc. 15

Enterprise Application Architecture™

Enterprise Application Architecture begins with an Information Capabilities Model

The diagram illustrates the Business Platform as the foundation for Enterprise Application Architecture. It is structured as follows:

- Reporting & Analytics**
- Profitability Management**
- Portfolio & Program/Project Management**
- Requirements Management**
- Strategic Sourcing**
- Manufacturing Planning & Execution**
- Installation, Service & Recovery**
- Suppliers** (left side)
- Customers** (right side)
- Business Platform** (foundation)
 - Ideation
 - Realization
 - Product Development & Lifecycle Support
 - Modeling & Simulation
 - Quality & Compliance
 - Enterprise Resource Management
 - Process & Data Backbone
 - Information Technology Infrastructure

The Business Platform is the foundation upon which the organization is directed. It includes business regulations, mission statement, core values & beliefs, strategic business plan, organizational policies, operating standards, governance, etc.

CIMdata Copyright © 2022 by CIMdata, Inc. 16

Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum

Enterprise Application Architecture™

Enterprise Application Architecture begins with an Information Capabilities Model

The diagram illustrates the Enterprise Application Architecture (EAA) framework. It is centered around a **Technology Platform** that supports a **BT Standard Operating Model**. Above this platform is the **BT Standard Capability Model**, which is organized into several functional areas: **DESIGN**, **STRATEGY AND INTELLIGENCE**, **IMPLEMENTATION AND OPERATIONS**, **DEVELOPMENT**, and **OPERATIONS**. Each area contains specific capabilities such as Strategic Planning, Requirements Management, and Production. The operating model is depicted as a flow from Suppliers on the left to Customers on the right, with **VALUE STREAMS** and **VALUE DRIVERS** indicated. Key goals include **INCREASE DIGITALIZATION** and **IMPROVE EFFICIENCY**.

The **Technology Platform** provides a sustainable foundation that considers integration, performance, deployment, and support of an enterprise application architecture.

The **Business Technology Standard**, or BT Standard, an open-source management framework to plan, or a similar framework can be used to form this platform (see managebt.org)

CIMdata Copyright © 2022 by CIMdata, Inc. 17

EAA: Business Transformational Capabilities

Information access, reporting, and guidance form the upper portion of the stack

The diagram shows the Business Transformational Capabilities stack. From top to bottom, the layers are: **Reporting & Analytics**, **Profitability Management**, **Portfolio & Program/Project Management**, **Requirements Management**, **Strategic Sourcing**, **Manufacturing Planning & Execution**, **Installation, Service & Recovery**, **Ideation** and **Realization** (under **Product Development & Lifecycle Support**), **Modeling & Simulation**, **Quality & Compliance**, **Enterprise Resource Management**, **Process & Data Backbone**, and **Information Technology Infrastructure**. The stack is supported by a **Business & Technology Platform** and is flanked by **Suppliers** and **Customers**.

- Universal access to all information produced by the organization
- Information is structured, found, and manipulated to derive insight
- The organization is guided by lifecycle profitability and portfolio management
- Requirements lead and the product follows

CIMdata Copyright © 2022 by CIMdata, Inc. 18

Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum

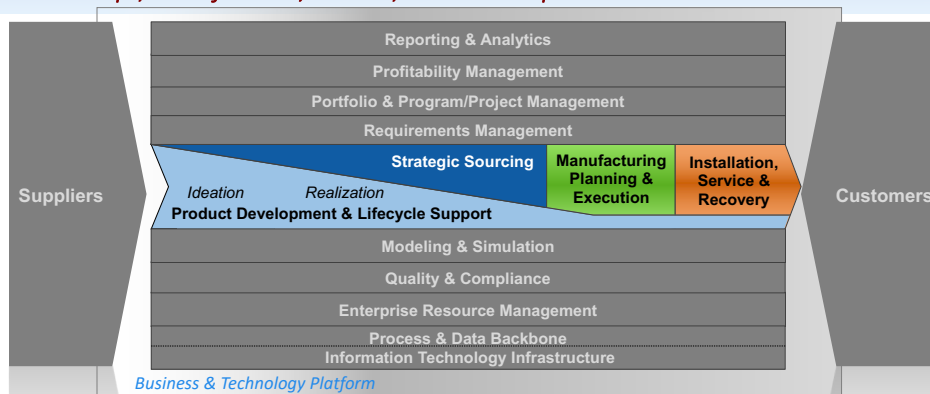
EAA: Business Transformational Capabilities

Reporting & Analytics, and Profitability Management

Reporting & Analytics	Automated Reporting	Crawling & Indexing	Custom Analytics	Executive Dashboard	Search & Find
	Predictive Analytics	Statistical Modeling	Data Visualization	Drill Down & Expand Up	Data Acquisition & Integration
Profitability Management	Market Identification	Market Forecasting	Product Forecasting	Product Portfolio Forecasting	Revenue Forecasting
	Cost Forecasting				

EAA: Value Chain Capabilities

The value chain develops, manufactures, delivers, and services products



- Tools to create and capture all product, sourcing, supplier, customer, manufacturing, and field service information produced by the business
- Product configurations, product architecture, and BOMs are developed & maintained
- Selection and integration of mechanical, electronic, and software components into a system/service and/or specifications, ingredients, formulas, and recipes

Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum

EAA: Value Chain Capabilities

Product Development & Lifecycle Support (partial set)

Systems Engineering	Platform Architecture	Modeling & Simulation	Requirements Management	Functional Allocation	Hardware / Software Integration
	Traceability Management	Verification	Validation / Testing		
Configuration Management	Part/Item Management	Bill of Information	Product Structure Management	Change Request Management	Change Notice
	Change Order	Release Management	Option/Variant/Alternative Mgt.	Technical Configuration Rules	Effectivity Management
	Planning & Management	Identification	Control	Status Accounting	Verification & Audit
	Specification Management	Ingredient Management	Formulation Management	Label Management	Recipe Management
Product Data & Process Management	Revision & History Management	Security & Access Control	Taxonomy & Nomenclature	CAD Data Management	Content Management
	Task & Workflow Management	Building Information Management (BIM)	APQP/PPAP	Lab Data Management (R&D)	

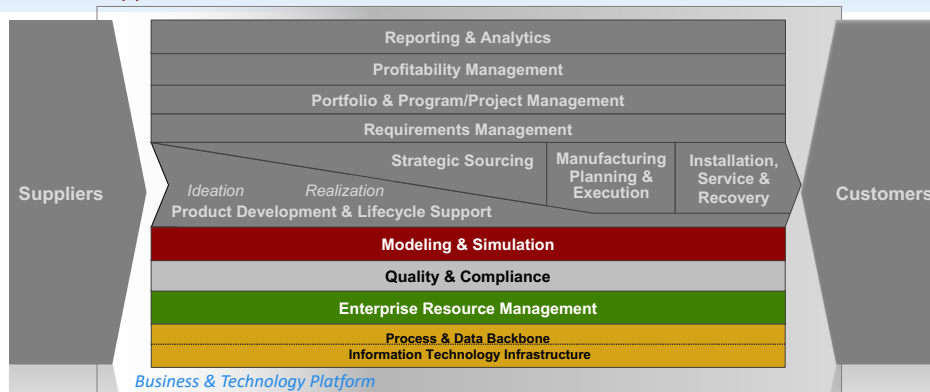
CIMdata®

Copyright © 2022 by CIMdata, Inc.

21

EAA: Foundational Enterprise Capabilities

The core capabilities support the value chain



- Modeling and simulation across the lifecycle and among all disciplines
- Collection and management of quality information to manage warranty costs
- Ensure compliance to customer, state, federal, and other governmental regulations
- Management of financial, human resource, sales, and customer data
- Information Infrastructure including servers and information services

CIMdata®

Copyright © 2022 by CIMdata, Inc.

22

Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum

EAA: Foundational Enterprise Capabilities

Information Technology Infrastructure (1 of 2)

Corporate Knowledge Management	<i>Knowledge Creation</i>	<i>Knowledge Recognition</i>	<i>Knowledge Management</i>	<i>Enterprise Models</i>	<i>Actionable Insight</i>
Corporate IT Management	<i>IT Governance</i>	<i>Obsolescence Management</i>	<i>Business Continuity Planning</i>	<i>Corporate Data Model</i>	<i>Corporate Process Model</i>
	<i>Contracts & Service Level Agreements</i>				
Enterprise Data Management	<i>Data Acquisition & Integration</i>	<i>Security & Access Control</i>	<i>Consolidation</i>	<i>Data Enrichment</i>	<i>Validation</i>
	<i>Translation</i>	<i>Syndication</i>			



Copyright © 2022 by CIMdata, Inc.

23

EAA: Foundational Enterprise Capabilities

Information Technology Infrastructure (2 of 2)

Data & Process Management Backbone	<i>IP Protection & Data Security</i>	<i>Content Creation, Capture & Management</i>	<i>Common Data Repositories</i>	<i>Data Visualization Services</i>	<i>Social & Collaborative Services</i>
	<i>Process & Workflow Management</i>	<i>Data Transfer</i>	<i>Application Performance Management</i>	<i>Openness</i>	<i>Backup & Recovery</i>
Data Governance	<i>Strategy</i>	<i>Policy</i>	<i>Standards & Quality</i>	<i>Oversight</i>	<i>Compliance</i>
	<i>Issue Management</i>	<i>Data Management Projects</i>	<i>Data Asset Valuation</i>		
Infrastructure Management	<i>IT Asset Configuration Management</i>	<i>Network</i>	<i>Data Center & Cloud</i>	<i>End User Computing</i>	<i>Mobility</i>
	<i>Enterprise Application Integration</i>	<i>End User Data Storage</i>	<i>Digital Rights Management</i>	<i>Disaster Recovery</i>	



Copyright © 2022 by CIMdata, Inc.

24



Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum

Enterprise Application Architecture™

Extensive end-to-end information capable framework

Enterprise Application Architecture		CompanyX					Threshold		
Updated: Aug 2020		Release 20					Current Capability %		
Focus Areas	Enterprise Information Capabilities					Heat Map			
ALL	Reporting & Analytics	Automated Reporting	Creating & Defining	Custom Analytics	Executive Dashboard	Search & Find	■	■	■
		Predictive Analytics	Statistical Modeling	Data Visualization	Drill Down & Expand Up	Data Acquisition & Integration	■	■	■
PLM	Profitability Management	Market Identification	Market Forecasting	Product Forecasting	Product Portfolio Forecasting	Revenue Forecasting	■	■	■
		Cost Forecasting					■	■	■
PLM	Portfolio Management	Initiation	Idea Management	Portfolio Profitability Management	Product Portfolio Planning	Brand Experience Management	■	■	■
		Customer Experience Architecture	Product Marketing Architecture	Sales & Market Configuration Rules	IP Management		■	■	■
PLM	Program Management	Program Status & Tracking	Program Planning & Control	Project Portfolio Planning	Issue Management	Phase Gate Transition Management	■	■	■
		Profitability Forecasting	Resource Management	Risk Management	Program Value Management	Schedule Management	■	■	■
PLM		Project Initiation	Deliverable Management	Cost Management	Resource Management	Schedule Management	■	■	■

We would be happy to review & share the details with anyone.

CIMdata
Copyright © 2022 by CIMdata, Inc. 25

Agenda

Enterprise Application Architecture: A Valuable Enterprise Framework

- Why Use an EAA Framework
- CIMdata’s EAA Framework
- Sample Use of an EAA Framework
- Concluding Remarks

CIMdata
Copyright © 2022 by CIMdata, Inc. 26

Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum

Assessing Current State: “As-Is” Architecture

In-scope capabilities heat map example

- A CMMI type maturity model exists for each capability, it has been used to assess and build roadmaps for more than 50 companies
- We have found that companies often have missing capabilities and/or have capabilities that are under performing

Limited Or No Evidence	Fair	Good	Out of Scope
---------------------------	------	------	--------------

*Only displaying Focus Areas within scope capabilities.

Defining Future State: “To-Be” Architecture

The “as-is” / “to-be” roadmap should address capabilities that are needed, when they are needed

As-Is

To-Be



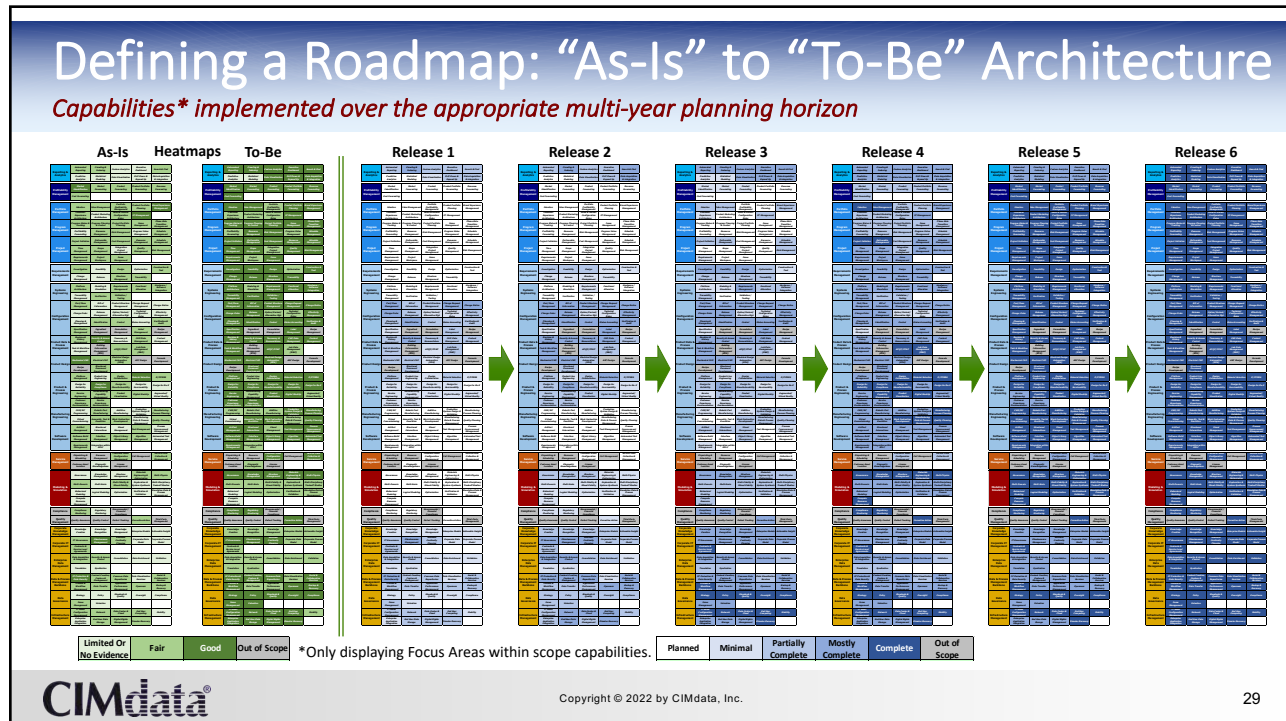
Key Benefits:

- Business plan enablement
- Real end-to-end business process enablement
- Cost, quality & time to market improvements
- Single logical source of truth
- Measurable ROI, IRR, etc.

Limited Or No Evidence	Fair	Good	Out of Scope
---------------------------	------	------	--------------

Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum



Other Uses of Note

Other areas where you have and/or will see the model being used

- PLM solution evaluation & comparison as part of an industrial company’s PLM journey
 - Extensively used in the request for proposals (RFP) supported by CIMdata
 - These include the company-specific EAA configuration
 - Request for quotations (RFQ) that includes the company-specific implementation roadmap EAA configuration
 - Focused use within benchmark activities that are often executed as well

CIMdata® Copyright © 2022 by CIMdata, Inc. 30

Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum

Agenda

Enterprise Application Architecture: A Valuable Enterprise Framework

- Why Use an EAA Framework
- CIMdata's EAA Framework
- Sample Use of an EAA Framework
- Concluding Remarks



Copyright © 2022 by CIMdata, Inc.

31

What is the Business Opportunity?

How can the PLM Economy best support and leverage this framework

- We seek to continue its development & support your understanding of it
- The model can provide a consistent & expansive framework as part of your assessment & roadmap planning processes
- How you can leverage the model:
 - Review and provide recommendations for additional Capabilities, Focus Areas, and perhaps even Application Areas—this helps build out the model
 - Perform a gap analysis to determine which Application Areas, Focus Areas, and Capabilities your solutions support, and which ones you don't
 - This can be used to determine weaknesses, as well as development priorities
 - Could also develop written responses to those capabilities your solutions cover, which then can be reviewed by CIMdata
 - This would help many of you perform better during future evaluation and selection processes supported by CIMdata



Copyright © 2022 by CIMdata, Inc.

32



Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum

Concluding Remarks

Enterprise Application Architectures can play a critical role in helping companies implement PLM

- PLM isn't implemented as a single IT system, but rather a set of solutions that enable a wide range of capabilities that must work together
- Getting an enterprise application architecture wrong, not only costs money, but potentially suboptimizes PLM's impact, as well as other applications
 - Failure is costly & not an option for most
- CIMdata's proven Enterprise Application Architecture™ framework can be used to help assess current application environments, define of implementation roadmaps, as well as guide implementations
 - The framework is open, scalable, and neutral
- CIMdata would like to partner with the broader PLM Economy to continue to build out the framework for the betterment of all



Copyright © 2022 by CIMdata, Inc.

33

To Learn More...

- Please contact me if you want to learn more
 - Peter Bilello, p.bilello@CIMdata.com, +1.734.604.0357



Copyright © 2022 by CIMdata, Inc.

34



Enterprise Application Architecture

2022 CIMdata PLM Market & Industry Forum



CIMdata
Strategic consulting for competitive advantage in global markets

World Headquarters
Ann Arbor, Michigan USA
Tel: +1.734.668.9922

Main Office - Europe
Weert, NL
Tel: +31 (0) 495.533.666

Main Office - Asia-Pacific
Tokyo, JAPAN
Tel: +81.47.361.5850

www.CIMdata.com

Serving clients from offices in North America, Europe, and Asia-Pacific

CIMdata
Copyright © 2022 by CIMdata, Inc. 35